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How Can Smart City Development be Used to Improve the Situation of Declining Cities: Examining the City of Hull

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MSc International Planning and Urban Design

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LIST OF ABBREVIATIONS

AI | artificial intelligence

BEEM | Build, Eliminate, Evaluate, Minimise

EU | European Union

ICT | information and communications technologies

IoT | Internet of Things

SDG | sustainable development goals

SmartOS | Smart Operating System

SWOT | Strengths, Weaknesses, Opportunities, Threats

UK | United Kingdom

UN | United Nations

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DISSERTATION SUMMARY IN TURKISH

Dünya genelindeki hızlı kentleşme nedeniyle fırsatlar, yatırımlar ve sermaye küresel şehirlerde yoğunlaşmıştır. Bu şehirler, sundukları olanaklar ile büyük göç almaktadır ve göç veren görece küçük şehirlerin sosyal, ekonomik ve demografik anlamda kayıplara uğramasına sebep olmaktadır. Ortaya çıkan dengesiz şehirleşme, imkân ve nüfus farkı ile sosyo-ekonomik olarak küçülen şehirler ortaya çıkmıştır. Bu bağlamda, kayba uğrayan şehirlerin istikrara kavuşabilmeleri ve ayakta kalabilmeleri için doğru planlamaya ve iyileştirmeye ihtiyaçları vardır.

Hızlı kentleşme şehirleri etkilerken, akıllı şehir yaklaşımı bilinir bir konu haline geldi. Akıllı şehirler, teknolojik araçlar ile şehrin dijital katmanları üzerinden toplanan verileri kullanarak, yaşam kalitesini iyileştirme, daha iyi kamu hizmetleri sunma ve geleceğe dair projeksiyonlar oluşturma anlamında iyi bir potansiyele sahiptir. Akıllı şehirlerin sahip olduğu bu potansiyel, sosyo-ekonomik olarak küçülen şehirlerin ihtiyaçları ile örtüşmektedir. Bu nedenle, küçülen şehirlerde dijitalizasyon ve akıllı şehir projelerinin uygulanabilirliği ve muhtemel sonuçları incelenmiştir.

Sosyo-ekonomik anlamda küçülen bir şehirdeki akıllı şehir girişiminin nasıl yönetildiğini anlamak için Hull şehri vaka çalışması yöntemi ile incelendi. Bu süreçte, akıllı şehir teknolojilerinin planlamadaki kullanım alanları araştırıldı, vatandaşların projelere katılımı ve haklarının nasıl etkilendiği incelendi. Akıllı şehir yaklaşımı ile sürdürülebilir bir geleceğe ulaşabilme ve sosyo-ekonomik anlamda kayıp yaşayan şehirlerin mevcut durumunun iyileştirilebilme ihtimali, toplanan verilerin analizi ile sunulmuştur.

ABSTRACT

Due to rapid urbanisation worldwide, opportunities, investments and capital have been concentrated in global cities. These global cities attract people with all the benefits they offer and have seen massive migrations, causing cities with considerably smaller economies to lose their population and economic strength. This uneven urbanisation and population distribution led to declining cities. In social and economic context, these cities need improvement to be able to stabilise their economy and keep their population.

While rapid urbanisation is effecting cities, smart cities approach has become a well known subject in urban planning. Using the technological tools and innovations, smart cities hold the potential of improving life quality, providing better public services, monitoring the city over the digital layers and through data collection. The potentials of smart cities overlap with the needs of declining cities. Therefore, feasibility of digitalisation in declining cities and possible outcomes have been examined through, taking usage of technological innovation into consideration.

Case study of Hull have been analysed to understand the governing of a smart city inititative in a declining area, explore the usage digitalisation and critique the citizen involvement and rights. Possibility of achieving a sustainable future and improving the situation in declining cities by the implementation of smart city approach presented through analysing the data gathered,

CHAPTER ONE | INTRODUCTION

The first chapter will start by clarifying the research problem. Research aims, objectives and questions will be defined to create an outline for the expected outcomes of the dissertation. A dissertation structure will be explained to emphasise what can be expected as an outcome and summarise the general approach that will be followed throughout the research.

1.1 Research Problem and Context

Two of the main headings relating to the dissertation are smart cities and declining cities. There are numerous researches, written papers about smart city development. People have examined approaches and impacts of smart cities within the academy and professional environment (Kitchin et al. 2019). Declining cities are also reviewed and examined by academicians and professionals to understand the problems and possible solutions against the decline (Wiechmann 2008). Even though declining cities and smart cities are covered widely in literature, there is a lack of critique and commentary for the feasibility and possible impacts of digitalisation and smart city development in declining areas.

Smart City projects are primarily planned in economically wealthy and expanding cities (Gaffney and Robertson 2016), and a significant amount of the researches relating to smart cities are about the wealthy and developed places. Due to that, research outcomes are limited with these places (Vu and Hartley 2018). Integration of the existing system and implementation progress of smart city projects is a more extended period than the expansion rate of a metropolitan city, therefore growing population pose an obstacle to sustaining the smart city implementation in metropolitan areas. Due to that, metropolitan areas will reach the saturation point regarding their urban development and expansion, so an inclusive examination for the usage of smart city technologies in considerably smaller cities and deprived areas can be more helpful to create new insights into the opportunities for the future of that deprived areas. It also has been argued by Harrison and Donnelly (2011, p. 6) that smart city approaches have the possibility of changing the cities in a good way, but there is a lack of theoretical debates and understanding of how.

From the declining city perspective, the overall approach of decision-making authorities in declining cities seeks to implement traditional planning policies to

overcome the decline for the future of their cities (Lima and Eischeid 2017). Besides traditional approaches, smart cities also have the potential of improving the declining situation and should be considered as a possibility. At this point, planning a smart city project and implementation of it in declining cities can be examined thoroughly to find out possible outcomes. With that, declining cities can gain a basic understanding for future developments to improve the opportunities in the city and give their population a reason to stay within their cities rather than migrating to metropolitan areas.

There are crucial issues to consider in smart cities such as financing system of the projects, governance, progress management, citizen privacy and citizen involvement which are expected to be affected by the use of technology cities. These issues need an in-depth examination to explore the feasibility of declining cities and find out possibilities related to the research topic.

To conclude, the focus point of this research is to understand how a smart city development can be used to tackle the problems of a declining city and provide a sustainable future. It explores through questioning the impacts of smart city projects to understand whether it improves the declining situation into a sustainable future for the city or not. Findings will be based on literature review and examined using the case study approach for the digitalisation, innovations and smart city initiative in Hull.

1.2 Research Aims

Exploring comprehensive account for the declining cities and critiquing iteratively whether Smart City developments provide convenience to improve the habitability, opportunities, protection of resources, sustainability, resilience, and preservation of that city by using Smart City technologies. Impacts and usage of information and communications technologies (ICT), artificial intelligence (AI) and Internet of Things (IoT) will be considered in the research and examination of the smart city initiative in Hull.

1.3 Research Objectives

The research objectives will be supported by literature review and findings through empirical data to achieve a relevant result within this dissertation. The objectives are as follows:

- The first objective is to examine the strategy development process and fulfilment of advanced digitalisation in a declining city.

- The second objective is to understand the implementation of smart city tools in Hull and the reason for usage specifically. This objective considers the impacts and the effectiveness of that implemented smart city tools.
- The third objective is to explore digitalised data usage in the city of Hull and understand how to create urban projects using that digitalised data and build a relationship with the city and its users.
- The fourth objective is to critique whether a Smart City development and digitalisation is able to provide a better future in a context of sustainability and resource efficiency for a declining city.

1.4 Research Questions

The following questions are chosen to help reach the research aims and objectives:

- How can digitalisation progress be held for a declining city?
- What Smart City technologies are being used, and what impacts do these technologies have over the city of Hull?
- How can citizens integrate with smart city tools considering their rights to the city?
- How will a Smart City project lead to sustainable city development?

1.5 Dissertation Structure

The dissertation has five chapters in total. The present chapter is an introductory chapter that consists of the research problem and context, research aims, research objectives, research questions and dissertation structure sections. These sections give a brief explanation about the reasoning behind the choice of the topic, research problem and research context. Then, the research outcome with aims, objectives and questions has been identified and followed by the dissertation structure that summarises all five chapters.

The second chapter presents an in-depth review of the literature and critiques the topics relating to declining cities, smart cities, and smart sustainability with their elaborated subtopics. Outcomes of this chapter create a base for understanding the dissertation topic and answering the research aims and questions.

In the third chapter, the methods that have been adopted to gather data, achieve research aims and answer the research questions in relation to the objectives are explained. The reasoning behind the selected methodologies, research design, data analysis, limitations and ethical considerations are also explained in the methodology chapter.

The fourth chapter presents the analysing and interpretation of the data that has been collected through different methodologies which are related to the dissertation topic. Interview and documentary analysis data help to provide a comprehensive outcome for the general research context.

The fifth and last chapter consists of a conclusion section that summarises the general outcomes and findings gathered through the dissertation. Following the conclusion section, recommendations for decision-makers and future researches are included in the last chapter.

CHAPTER TWO | LITERATURE REVIEW

The literature review outlines the topics of declining cities, smart cities and sustainable futures to be able to understand the research aim and find answers to the research questions. This chapter starts by examining problems of the declining cities, possible solutions, and ways of implementing technology in smart cities. Then, followed by an explanation of smart cities with the subtopics of citizen involvement and rights, digitalisation, technology and data usage. This chapter is completed by a section to sum up the topic of sustainability, including literature on sustainable futures, and express how it can be achieved for declining cities to improve their situation through innovative digitalisation.

2.1 Declining Cities

2.1.1 Understanding the Declining Cities

Through the past decades, worldwide globalisation of cities and economies has been concentrating sources, investments, employment opportunities, and various assets in "global cities" (Sassen 2011). The global cities are receiving an increased number of migrations from other cities due to improved employment facilities, benefits of opportunities and better living standards with their comprehensive infrastructure (Wolff 2018). All the improvements and investments in global cities have created prosperity, and with their continuously improving situation, these cities can also provide essential opportunities for educational institutions to set an advanced agenda and businesses to strengthen their investment and expand (UN Habitat 2013). On the contrary, the rapid change and improvements in global cities have led to a shift of capital and population to the global cities from other cities with considerably fewer opportunities and resources (Martinez-Fernandez et al. 2012). The shift and outflow of the capital and population in non-global cities causes emigration to increase and gives rise to small-sized cities losing their economic strength, opportunities, and human resources (Martin et al. 2016). By the means, the growth in economy and population is being declined in these cities, which affects the social and economic context. Cities, whose economy based on a single industry or a "cluster of interrelated industries" have notably faced the effects of decline (Lang 2015; Golubchikov et al. 2015 and Restrepo Cadavid et al. 2017 cited in Golubchikov 2020, pp. 9-10). Cities facing these problems in social and economic contexts are called "declining cities" (Martinez-Fernandez et al. 2012).

Many aspects that create a city, such as an environment, infrastructure, resources, provided services and social context, are most likely to suffer from the unwanted outcomes of a decline. The decrease of population is one of the critical aspects that has crucial effects on the governing of a city. Unexpected population loss can cause a fall in water, electricity, and gas consumption, which will turn future projections and calculations for the service infrastructure investments upside-down (Moss 2003). This consumption change means a loss of customers and demand for the service providers and infrastructure investments made by the authorities, which will dramatically damage the economy (Moss 2008; Monstadt and Naumann 2005). When this economic damage adds up to the existing economic recession, which is caused by the decline, it will result in a vicious circle which is an undesired scenario.

Problems of declining cities can be seen as an issue that concerns that specific city. However, the unbalanced distribution of population caused by unequal economic situation and opportunities in between prosperous and declining cities in a country are the beginnings of uneven urban growth (Cunningham-Sabot and Fol 2009). Due to the undesired consequences of an unbalanced distribution of population, unequal opportunities and uneven growth, declining cities require well planned and efficient projects to improve their situation and create a stable position for their future (Pike et al. 2016; Romanelli 2017).

2.1.2 Overcoming the Decline

It is important to look at official statistics about population and economy in a deprived area to offer possible solutions. However, it will not always be ideal to analyse a decline by only looking at these two parameters. A deeper examination of the social and economic context considering the opportunities within the city, public services and citizen needs will give a more in-depth understanding (Martinez-Fernandez et al. 2012). While depopulation has negative impacts on a city, it has been argued by Hartt (2019) that the loss of population should not be concerned as a dead end for cities, and depopulation and other negative impacts of decline be reversed into an opportunity. In a declining population, implementing a project will be relatively easier than in a rapidly urbanising city, excluding the financial problems.

Declining cities focus on planning to create a self-sustaining future for their citizens and improve opportunities (Lang 2005). These opportunities are able to be created and improved by the collaborative work of the council, participation of citizens,

universities and non-governmental organisations in the city. As shown in Figure 1, development plans in declining cities need connection in between physical, environmental, social and economic contexts to achieve a comprehensive regeneration.
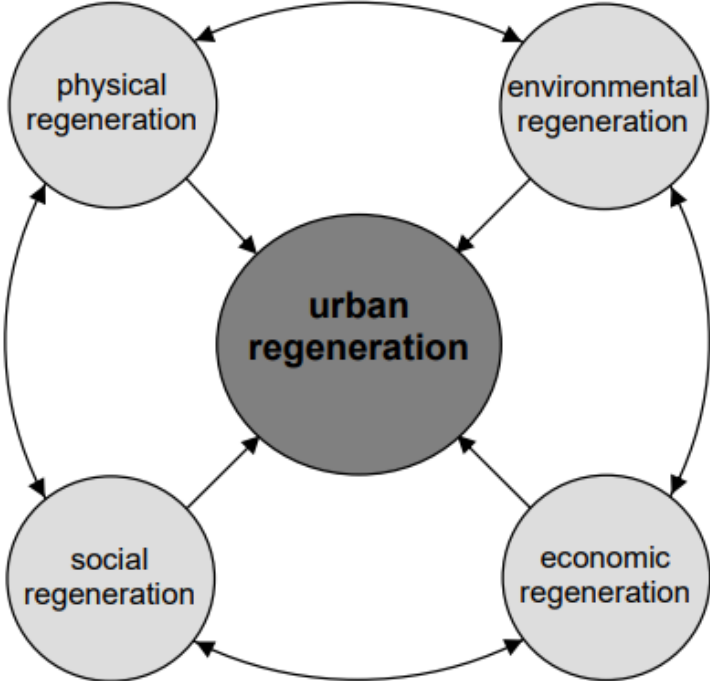
Figure 1: The Concept of Urban Regeneration (Lang 2005)

Improving opportunities and creating a position for positive immigration in declining cities are also essential to provide homogenous population distribution in countries. As global cities have economic investments and migration, there is an overload on these global cities worldwide, causing environmental and urban problems (Sun 2020). A possible solution to indicate uneven urbanisation will be improving the situation of declined cities by providing opportunities and creating a sustainability approach through urban regeneration. When the need for a sustainable future in declining cities combined with the opportunities and easiness that could be provided with smart city technologies, the ideas lead to critical thinking of the possible outcomes that can be achieved through digitalisation of regenerations in declining cities. Smart city development will be used as a tool to prevent the declining situation and provide sustainable futures in the meaning of urban development.

2.1.3 Integration of Technology in Declining Cities

Declining cities can face budget limitations as a result of their economic decline (Hall and Jonas 2014). A limited budget can restrict the options for possible planning projects and investments. Therefore there has to be an efficient way to overcome challenges to improve the life quality and easiness and attract businesses to employ new opportunities. Despite the cost of implementing the technology and maintaining the system (New and Castro 2015), technology implementation is an investment for the future that and is able to reduce costs. Creating a smarter system and infrastructure will increase performance and lower costs by maintaining a longer and more efficient life cycle (Bowers et al. 2017; Cordella and Iannacci 2010). This cost-efficient system can be achieved by having a transparent open data sharing system, saving time by cutting off unnecessary procedures in bureaucracy and providing efficiency with simplification and accuracy of analysed data through the usage of ICT, IoT and AI (Deng et al. 2018; Devenyi et al. 2019; Lytras and Şerban 2020). Once the cost-efficient system is built for the smart city applications, these applications can improve liveability, provide flexible planning, and create new employment opportunities by using technology combined with urban planning policies (Thuzar 2011). Also, the rapid increase in usage and improvements in AI and data related technologies makes it more accessible, resulting in the fall of technological cost (Golubchikov and Thornbush 2020), which increases the feasibility and implementation of these technologies in declined economies.

Usage of ICT, IoT and AI in cities "restructures many domains of social life" (Golubchikov and Thornbush 2020), which will lead to a more comprehensive approach in the governing of cities. Usage of given technologies improves the integration of the city and its citizen. E-governance is one of the most critical applications that help increase the interaction between citizens and local authorities, speed up access for public services, optimise administrative processes and monitor the infrastructure systems (Lytras and Şerban 2020, p.65314). Integration of an e-governance system together with accessible open platform and data for both citizens and local authorities will increase the effective usage of smart city tools and social inclusion (Grimsley and Meehan 2007; Lytras and Şerban 2020), which can be crucial to improve the life quality and emphasise the feeling of being included and valued by the local authority for the population of a declining city.

Integration of technology in declining cities creates a comprehensive approach where technology implementation, data collection, data processing, and decision-making connect with each other. In the making and working of this structural system, rapidly increasing improvements in the field of AI and machine learning are key factors. Any dataset that has been gathered through digitalisation steps in a city must be analysed and understood by the authorities to implement projects accordingly. Otherwise, the efficiency of digitalisation will not be ideal. As pointed out in different aspects, examining data is more crucial for declining cities due to their need for high efficiency in investments and seeking solutions to improve the situation. The structural usage of AI and machine learning for "information process" throughout the steps shown in Figure 2 has the potential to eliminate unnecessary data and increase the "data value" (Bowers et al. 2017), which will save time and allow focusing on what matters for authorities in declining cities. Figure 2 reflects the importance of gathered data processing in the decision making phase.
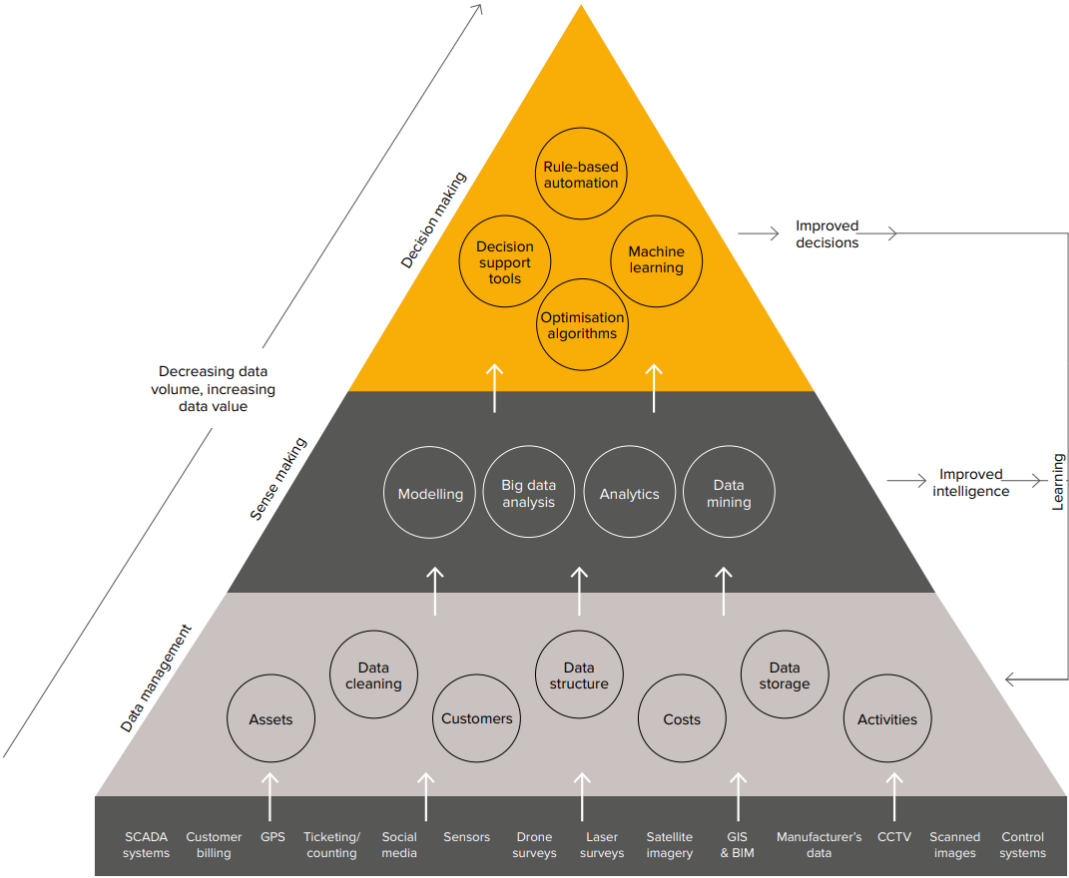
Figure 2: Digital Structure: Decreasing data volume, increasing data value (Bowers et al. 2017)

Preferring a participatory and progressive attitude can be beneficial for the continuity of the system and providing a certain level of standards. In addition, being included in the establishment of smart city integration can generate positive public acceptance of governing authorities (Cordella and Iannacci 2010). As an example, collecting information from non-people centric data and related environments in order to build more customised solutions for the good of citizens again. Promising improvements of digitalisation and technology use will be considered in improving declining cities.

Citizens being one of the cores that create cities, and most of the reasoning behind the integration of technology, digitalisation initiatives in declining cities starts with considering citizen usage, wellbeing and integration. Therefore, in the making process of smart city projects in declining areas, a sustainable future development starts by prioritising the social integration of citizens through a shared process, and policymaking progress should keep evolving by considering the citizenship perspective (Macke et al. 2019).

2.2 Smart Cities

2.2.1 Smart City Approaches and Citizen Rights in Smart Cities

Smart cities are using the data that will be collected within a city. Through gathered data, smart cities aim to improve infrastructure and life quality, provide accurate information for transportation, increase responsiveness in the city, create sustainability and resilience through monitoring environmental measures and connect vital services such as healthcare and security to adopt a proactive approach through advanced digitalisation (Thornbush et al. 2013; Yigitcanlar et al. 2018; Yigitcanlar et al. 2019; Golubchikov 2020; Thornbush and Golubchikov 2021). In simplification, smart city concepts use high technology applications and digitalised strategies to improve the urban system and generate opportunities for a city (The Organisation for Economic Co-operation and Development 2020). Considering the general definitions, Giffinger et al. (2007) categorise the characteristics of a smart city in contexts as" smart economy, smart people, smart governance, smart mobility, smart environment and smart living", which will be explored through the dissertation.

In spite of creating impressions like a simple implementation of technology for similar reasons and aiming to achieve similar goals in urban planning, cities in various

countries have developed different views for smart city projects. These distinctive views depend on the economic situation, use of technology, city characteristics, and general approach in the development and political system. When all these parameters are taken into account for smart city development projects around the world, the existing smart city approaches can be simplified and examined as top-down and bottom-up approaches (Breuer et al. 2014).

Implementing technological tools for monitoring and controlling all mechanisms that form a city to provide better conditions for citizens (Hall et al. 2000) can be considered as a top-down approach due to being directed and controlled by the authority and technology companies. The top-down approach has been adopted by smart city developments to speed up the process and. Despite aiming to improve the life quality in the city and act faster for the city, there are disadvantages of the top-down approach where it misses the importance of progress, participatory development and humanly needs in the planning phase (Gooch et al. 2015). Depending on the reasoning behind the project, having a top-down approach will not be able to develop a further relation between the city and the citizens to create a common sense for the future of city planning due to the lack of citizen participation.

Another approach that has been put in action by the cities that are implementing smart city technologies and developments is the bottom-up approach. It reflects the idea of starting urban planning with the participation of citizens and collaborative work with responsible authorities, implementing projects by considering the needs of the city, gathering information and evolving through the progress (Nabian and Ratti 2012).

When responsible councils adopt a bottom-up approach, it needs to be spread over time to see the causes and effects of the projects. It is crucial to learn through progress in digitalisation. Importance of the progress in smart cities stated by the Department for Business, Innovation and Skills (2013, p.7) as "…there is no absolute definition of a smart city, no endpoint, but rather a process, or series of steps, by which cities become more liveable and resilient…" to emphasise a continuative approach.

Taking a progressive open-ended approach in Smart City development will benefit a city considering the constant changes that have been faced in the cities. Moreover, this progressive point of view can provide flexibility and adaptability through time.

Although smart cities seem like a promising solution for the future of our cities, they are quite criticised for excluding different groups of people. As Kitchin (2016) explained thoroughly, the system planned to think of the urban as a predictable area and ignored the rights of citizens. Therefore, it has been argued by Kitchin et al. (2019) that the smart city ideas need a reconsideration based on human rights, control mechanisms and urbanism. In short, Kitchin (2016) outlines and states that we need to "reframe, reimagine and remake the smart city" for better.

An increase in the ageing population and the potential exclusion of the elderly in smart cities is another concern regarding citizen rights (Bleja et al. 2020; United Nations Economic Commission for Europe 2020). It is mainly related to the elderly not being able to access and interact with technology as other age groups. While the interaction with technology is useful in smart cities, usage of technologies proactively in healthcare such as "diagnosing disease, assisted living for an ageing population" (Golubchikov and Thornbush 2020) aims to respond to the needs of elderly people and minimise the contradictions. To reduce any extent of exclusions in smart cities, various socio-demographic groups need responsiveness by relevant use of technology.

Besides general concerns about the rights of participation and involvement, other extensively discussed contradictions about citizen rights are the privacy and security of personal data in smart cities. With the rising use of IoT and the increasing number of data collected, there have been limitations and problems regarding the vulnerability of the technological applications and the privacy of the data collected (Hsu and Lin 2016)

These positive and critique approaches display the contradictions in smart city theories. If smart cities are used as a tool to shape our cities for a better and balanced future, it sure does have good use. In the research, the social side of technology and digitalising a city should always be prioritised. Eventually, it is something that needs a control mechanism, not something that rules human life. A mutualist relation between the citizen and the smart city can be discussed. It makes the lead for the use of smart city technologies, governing the control mechanism and usage of data collected (Anthopoulos 2017a).

2.2.2 Data Collection, Data Usage and Innovative Technologies

As mentioned by Golubchikov and Thornbush (2020), a smart city is "non-static, evolves over time, and involves human capital, social capital, hard infrastructure, and ICT technologies in the provision of a sustainable environment", which reflects the value of evaluation through time in smart cities using the advanced technologies. This urban ideology will play an important role in positively changing the future of the cities that we live in.

Smart cities tend to follow ICT, and instead of separated use of technologies, projects are planned to create a digital layer that responds with each other over a digital network (Anthopoulos 2017b). With the use of IoT to connect a great number of devices on the existing ICT, smart cities offer advanced data collection and monitoring for various purposes (Rajab and Cinkelr 2018). Through innovative technologies such as ICT, IoT and AI, the potential of smart cities and expectations arise.

Having access to real-time data with accuracy will be used by authorities to monitor traffic, public services and infrastructure, which will enable to react events faster and create a standard for the cities worldwide (Harrison and Donnelly 2011). Besides being used for governing bodies, sharing the simplified data will lead to numerous opportunities and innovative applications by different sectors. Through the usage of AI and machine learning, open datasets will be extracted into valuable data (Bowers et al. 2017) to be used by businesses. This will become an external supporting body along with authority. Businesses using open data have the potential of adding new perspectives and offer straightforward solutions.

From the council point of view, accessing accurate data leads the way to the implementation of spot-on projects. Encouraging the use of data for the public sector and businesses (New and Castro 2015) will speed up the experimenting process for smart cities. Experimenting with outcomes of the data usage in a shorter amount of time will support the progressive approach, and effective usage of the data can lead to achieving the supposed aims of smart cities mentioned in the literature (Thornbush et al. 2013; Yigitcanlar et al. 2018; Yigitcanlar et al. 2019; Golubchikov 2020; Thornbush and Golubchikov 2021).

2.3 Smart Sustainable Cities

Sustainable development has various meanings depending on which context it has been related to. For a city to have sustainable development, that development should consider economy, society, and politics (Batagan 2011). Many vitally essential sources are in danger with the ecological crisis, and sustainability has been a globally important topic. This ecological crisis led to a global call by the United Nations (UN) to create sustainable development goals (SDG) and suggest the adoption of SDG for the future of the world (United Nations 2015). These development goals should be prioritised by planning and governing bodies to achieve a sustainable future faster. On the way to reaching these goals, technology has an essential role due to creating flexibility, offering productivity and easiness. Improvement in the digitalisation area are offering many development opportunities for cities for more than four decades, and the cities that are using these technological developments and digitalisation have been more common around the world (Glasmeier and Christopherson 2015).

Sustainability and smart cities are being well known concepts for many years. However, the term "smart sustainable cities" have been explored and researched in recent years (Bibri and Krogstie 2017; Golubchikov 2020). Implementing high technology features to achieve sustainability goals is a significant step in speeding up the process and using the opportunities. However, just like many theorems creating contradictions, the smart sustainable cities concept has also been questioned. The foreseen problem about smart sustainable cities is that technology surpasses the aims, and it is not able to provide socially and environmentally sustainable development (Evans et al. 2019).

In smart city initiatives, to prevent these foreseen problems and provide a robust and sustainable future for a city, technology should be used as a tool to help improve the city and always prioritise the citizens, to create not just environmentally sustainable places but socially sustainable places (Trindade et al. 2017). Smart sustainable places aim to improve the quality of life by integrating infrastructure and technology to benefit citizens and the environment (Yigitcanlar et al. 2019; Fialová et al. 2021). It has been argued by Golubchikov (2020) that "smartness is certainly one of the enabling conditions for improving sustainable development, but at its core must be people, citizens, and communities." which emphasises the importance of a human-centric approach to provide sustainability in smart cities.

An improvement for the future can be provided by creating a sustainable system for the social and economic context, employing opportunities and having resilience. These improvements are more vital for cities with considerably smaller economies and are losing population (Martinez-Fernandez et al. 2012). Managing these improvement projects with flexibility and resource efficiency is crucial to achieve a sustainable future for declining cities.

2.4 Conclusions

Ideas have been presented through various perspectives in this chapter by examining the related literature. The literature review has shown diverse possibilities of thinking on smart cities, declining cities and sustainable futures. With the broad opportunities and imagination that can be accessed through digitalisation, planning city futures can be developed progressively and be flexibly by the authorities in declining cities.

A broad range of topics related to the rapid increase and expansion in smart city projects has been mentioned and discussed by Dameri (2013), Anthopoulos (2017a; 2017b) and Golubchikov and Thornbush (2020). The ideas that have been stated in the literature review create a provocative thinking environment about the contradictory discussion about smart cities. These contradictions must be revisited before considering smart city projects in declining cities. To critique and find possible solutions for these contractions, the usage of technology should be analysed to achieve a common good for different aspects, and an inclusive approach built by participation and shared process of development by the involvement of citizens, stakeholders, authorities and businesses should be concerned (Alshuwaikhat and Nkwenti 2003; Dameri 2013).

Detailed researches and articles are helpful to keep an eye on a specific area. Ethical issues discussed and explained about smart cities (Sholla 2017; Clever 2018) remind an essential concern in the use of technology. Data usage is a crucial aspect in smart cities, and the way data is being used should be shared transparently with the users. In this social context, research by Kitchin et al. (2019) and proposals by Kitchin (2016) shows how to handle a topic and outcome logically. Having a different look from the social context makes the examination cohesive. Just like using advantages of various methodological techniques, examining multiple contexts are advantageous.

To find out more details about the possible usage of innovative digital technologies and their usage, Golubchikov and Thornbush (2020) brings examples and discussions about AI and robotics. These innovative technologies can be critical in reaching a relevant conclusion at the end of the dissertation and relating findings with Hull and the dedicated SmartOS (Smart Operating System).

Considering relations and possibilities between declining cities, smart cities and sustainability, smart city approaches has the potential of overcoming the decline by efficient solutions, offering long term projects that evolves through time with having adaptability and flexibility and creating sustainability in the social, economic and environmental context. Figure 1 reflects the basics of traditional urban planning, which can be used identically when a smart city initiative is planned for a declining city. To support the idea of digitalisation in declining cities, structural system visualisation of progress steps in Figure 2 demonstrates the feasibility of the system, and it will guide to an efficient implementation of technologies in declining cities.

CHAPTER THREE | METHODOLOGY

3.1 Introduction

The methodological strategy of this research is structured considering the research aims and objectives. Research methods have been explained in this chapter to create a cohesive structure and find appropriate answers to the research questions through examined papers and reports.

3.2 Research Design

3.2.1 Mixed Methods

There will be a need for close-ended to be able to explore real-life outcomes of the smart city initiative and open-ended data to achieve the research aims and objectives of the study by examining subjective planning policies.

Statistical data will be needed to explain details on a relevant and concrete basis. At the same time, there is also a need for open-ended data to create an arguable environment and understand through the process of critiquing smart city development due to being a contradictory topic. As stated by Næss (2016), "In order to integrate knowledge about causal influences at the level of the individual and the city level, a combination of qualitative and quantitative research methods is recommended." Therefore, a mixed method of qualitative and quantitative research will be adopted. Data collected through selected methodologies will be either supported or criticised with their correlation with statistical data.

3.2.2 Case Study

A case study is a comprehensive analysis of a single unit with an aim to generalise the findings to a greater extent (Gerring 2004, p.341). Having intensive research through a case study is helpful to have a detailed understanding of a problem in the real life context (Crowe et al. 2011). Considering the research topic, examining the impacts of ongoing smart city developments in a declining city is crucial.

Facing a decline significantly through the last decades of the 20th century and feeling the grim impacts of decline with the start of the 21st century, Hull is a suitable declining city to study. Besides that, reacting to decline through council-led projects that include smart city initiatives and eagerness of becoming one of the leading smart cities in the UK, Hull city is a relevant fit regarding the smart city context of this research. In the study, the ideas through the process, technologies used in the city to

solve the projects and outcomes with impacts will be examined. This will create an extensive perspective of the advantages and disadvantages a smart city project can have over a city. Being advantageous by examining a unit in extensive analysis, the case study will lack comparison with other relevant units. A valuable variety of data will be researched to minimise the lack of comparison,

3.3 Methods of Data Collection

Multiple data collection methods are chosen regarding the research strategies are explained under primary and secondary data sub-topics. These methods will guide to answer the research questions and achieve the research aims.

3.3.1 Semi-Structured Interviews

To answer the research questions, considering the planning and implementation phase of the smart city projects in Hull, semi-structured interviews with the responsible organisations are crucial. It will help understand how they see the problems and how they take measures against the problem of declining. In cities with smart city approaches, the steps taken may need a closer look, therefore, should be discussed with the project developers. This approach is widely used in smart city related projects around the world (Cugurullo 2017; Miller 2019).

Within the interviews, it is aimed to examine all the progress made by the interviewees in detail to come up with a conclusion. Target groups are essential to gather this data correctly and accurately. In addition, target groups should be directly involved or interact with the smart city development projects and have in-depth knowledge about the topics.

Considering the expectations; prospect interviewees have been divided into target groups, and the reasoning behind it is specified as below:

Target Group 1 - Hull City Council Smart City Project Leaders:

Hull City Council is leading the smart city projects, digitalisation and investments in the city with collaborative work. Smart city project Leaders are responsible for the progress of these projects. Therefore they have the experience and in-depth knowledge about the development and are the primary data sources. The critical topics to be discussed in the duration of interviews will be the ideas behind the developments, connections with the

digitalisation, how they are handling the financial steps, and improving the opportunities around the city.

Target Group 2 - University of Hull Urban Researchers:

There are reports about the improvements in the city of Hull by the university. Urban developments and investments in Hull are reported, including the digitalisation progress. The researchers have the theoretical knowledge and examined the practical outcomes of the Hull City development. Comparing the past and today of the city and looking at the future, existing database, and knowledge of the researchers is crucial for the research.

Target Group 3 – Connexin Company

Connexin is a technology company collaborating with the Hull City Council for smart city projects by the use of IoT. They are teamed up with Cisco, a Silicon Valley firm, to improve the urban infrastructure of Hull with intelligent solutions, IoT and AI. In the interview with professionals in Connexin, questions regarding the structural system of IoT, smart city technologies and the advantages and disadvantages of collaboration with the council will be asked. The answers given by professionals to these questions will give a broad understanding of the logic behind smart technology usage.

Target Group 4 – Smart City Project Leaders and Technology Companies in Different Cities

To develop a further understanding of smart city projects in other cities and gather comparable data, the interviewee profile will be widened by smart city project leaders, academics and professionals in different countries and cities. Through that, different signs of progress, outcomes and ideas about smart cities can be presented. It will help develop a future projection to continue smart city development in Hull and discuss possible outcomes.

The importance of the interviews is collecting data from the primary source and interacting with the interviewees who are responsible for the projects and have in-depth knowledge. This will give new perspectives at examining the research topic. Only

having interviewees related to projects in Hull can be one sided and limit the learning and discussions through research. Due to that recruiting the target group 4 is crucial.

These interviews were completed online due to COVID-19. Interviews have been completed online via Zoom and Microsoft Teams.

During the recruitment process of interviewees, each person has been briefly informed about the dissertation topic, research aims, research objectives and expected outcomes. Target groups have been contacted via mail, LinkedIn and social media. A consent form has been sent to each interviewee before interviews.

Due to unexpected change of circumstances, intense schedule and personal decisions of some contacts, none of the interviews planned within target group 2 occurred. Even though part of academicians and professionals are not available for interviews, they have sent their seminar presentations, research, and papers related to the topic to help and contribute to the data collection of this dissertation. Therefore, these additional documents sent by the contacted academics and professionals have been used in the fifth chapter as part of the documentary analysis with the appropriate referencing and citation.

Besides failing to perform some of the interviews, part of the interviews has been completed without recording due to interviewees not accepting consent forms. During the interviews, which were not recorded, essential points related to research aims, objectives, and questions were written down by taking notes. Interviewees who have signed the consent form and those who have not signed the consent form will be quoted anonymously during the dissertation.

Interview consent form and interview questions for each target group and related research questions are presented in appendices.

3.3.2 Secondary Data: Document Analysis

Analysing documents as a secondary data source covers the examination of digital and printed material (Bowen 2009, p. 27). These examinations require interpretation of the data to gain knowledge and better understand the material (Corbin and Strauss 2008). Documents can be used to support the primary data and improve awareness about the topic. It is a valuable way to gather an impressive amount of data in a given time (Bowen 2009).

Documents examined to enhance the database and understanding of the research topic through analysis and discourse will be; council policies, university reports, European Union (EU), UN and UK reports, urban journals, media news, and webinars related to Hull smart city projects.

Document analysis has the advantage of exploring various perspectives by reading the materials and comparing them through an interpretive approach. Despite being advantageous, there are disadvantages and risks of document analysis. A part of publishing articles is possible to be subjective and give misleading information about the research area. Therefore, it needs to be studied in detail and compared with other documents to avoid any misinformation that might lead to irrelevant outcomes.

Besides printed or published academic and council resources, news and information on high tech companies involved in smart city projects can be used to support ideas and complete the gaps of literature review. Even though they are not as reliable as academic sources, they can create a discussion environment to criticise the news. They can also lead to a finding of related news and reaching out to better sources.

3.3.3 Correlational Research

Correlational data enables two or more variables to be compared with each other and clarifies a pattern (Groat 2013, p.269). It is a tangible value that can be used to connect two data to develop a result. Despite seeming irrelevant to the topic, using statistics to create a correlational chart can be helpful to evaluate the impacts of digital implementations on the city. For this, statistical data of Hull about population, migration, employment, income and investments will be collected.

This method can also be used to look into digital technologies and data usage in a declining city compared to smart city projects in global cities. With such comparison, the fundamentals of smart city initiatives in different cities, which have the exact opposite situation, can be understood better. It will also help to visualise the real-life impacts of the initiatives, reveal a complete result of changes and how it changed the declining situation in the city of Hull after all the planning projects.

3.4 Style and Method of Data Analysis

There are commonly practised methods of analysis for both qualitative and quantitative data. Depending on the workload and time consuming, the style of analysis is subject to change. In the meantime, having detailed and varied styles can contribute to different contexts within the research.

Besides commonly practised and accepted styles, the data visualisation technique can be used for all data collection methods. Visualised data generates information to explain a subject with ease and obtain an explanatory impact on the text. It is possible to be used according to the occasion.

To have conclusions, find out the cause and effects of an action with an infographic; the strengths, weaknesses, opportunities and threats (SWOT) analysis of the chosen topic and interpretation of the SWOT data through questioning how to "build" on strengths, "eliminate" weaknesses, "evaluate" opportunities and "minimise" the threats (BEEM) will be used. SWOT analysis will help to clarify the reasoning behind problems (Singh 2010), and BEEM analysis will offer further solutions by interpreting the SWOT data. SWOT and BEEM analysis will be included in various parts to strengthen and simplify the explanation.

3.4.1 Discourse Analysis

For the qualitative data that will be gathered through the interviews and documentary analysis, creating a common ground and analysing them together will increase the cohesive style in the research. Discourse analysis can be completed in various ways, and it responds with different factors (Potter 2004). Based on social grounds, discourse can help to follow patterns and related subjects depending on interpretations made. It is a long process of examining the text and dividing it according to subjective sub-topics. Even though it resembles a complexity, it is capable of bringing much more detail into the context of the research once finalised. Having a social context outcome has the potential to improve the examinations through the dissertation.

3.5 Ethical Considerations

For the data collection, ethical concerns should be pointed out as a prerequisite. Appropriate examination of ethical issues helps to complete the dissertation concerning rights and ethics. Ethical problems will be considered throughout the

research and data collection to prevent any breach of personal rights. As specified in the ethical approval form and interview consent form, which can be found in appendices, each data found through primary sources will be collected and analysed with the source's consent, if otherwise specified. Questions in interviews will be related with the topic and there will not be any personal discussions or questions to avoid any sensitive or personal topic.

The reliability of sources and interpreted parts will be examined for the secondary data to avoid any ethical breaches. Otherwise, ethical considerations are considerably fewer in secondary data analysis due to them already being published and peer-reviewed.

Limitations related to COVID-19 has affected the data collection process and completing a proposed method. Brief commentary about these limitations has been added in the appendices.

3.6 Conclusions

Within these academic researches and political publishings, theoretical debates are found to examine the results of a progressive plan, considering the future of a city from scratch and gaining a new perspective to seek out creative solutions with smart technologies in a declining city. Throughout the qualitative and quantitative data collections, research is expected to find beneficial results comparing the ideas and case studying the city of Hull to provide new informative data for future research.

Considering the declining cities in this research, an important point should be criticising the academic and political views about Smart Cities and comparing their theoretical and practical thinking by using the methodological approaches during analysis.

CHAPTER FOUR | ANALYSIS and INTERPRETATION OF DATA

The fourth chapter will express essential findings related to the dissertation topic with the data collected and analysed through dissertation progress by using the methodologies mentioned in the previous chapter. Details that have been gathered will be presented to answer the research questions.

4.1 Governing the Smart City Initiative in Hull

Due to the particular disadvantage of being reliant on a specific industry, as mentioned in the literature by Sassen (2011), Martinez-Fernandez et al. (2012), Lang (2015) and Golubchikov (2020), Hull has faced a decline in population and jobs and deprivation (Martin et al. 2016) after the rapid loss in the fishing industry. As stated by interviewee #3:

> *"In the Victorian times, Hull was a really important city because it was a centre for whaling… and after that, there was fishing, massive fishing fleets, but they declined in the 1960s and 1970s especially with the Cod Wars with Iceland. Never really got anything back. So we had a huge mass of people employed in the fishing industry, and that went, we did not have anything left with that. So from the 1970s and 1980s and 1990s, Hull was quite deprived and declined and anything else."*

After a rapid decline of population and economy towards the end of the 20th century and the first decade of the 21st century, Hull Council has started to take action by planning projects and investments that will lead to an improvement in the future. These projects have started during ongoing development projects. However, this development process has been quite challenging for the city of Hull. Hull city council had to deal without funding for their planning and smart city initiatives. Besides the economic recession that decline brings, dealing with problems on their own slows down the improvement process and negatively impacts the city.

> *"…in the 2000's we started to get some regeneration. (Hull city council) had a better way of thinking. We won the city of culture 2017, and people found the pride in the city as well, so we said; actually, we are good, we have got a lot to go for it. You know we have got a lot going for us. We have got huge history, culturally we have got a lot going through as well. Because we are on our own, we do not expect people to help us, we do it ourselves because that is the way it has always been." (Interviewee #3)*

Figure 3 demonstrates the population decline of Hull at the end of the 20th century. Loss of income and unemployment forces people out of the city, and uncertainty for the future also causes the decline of natural growth.

Population increase with
- positive migratory balance and positive natural balance
- positive migratory balance and negative natural balance
- negative migratory balance and positive natural balance

Population decrease with
- negative migratory balance and positive natural balance
- positive migratory balance and negative natural balance
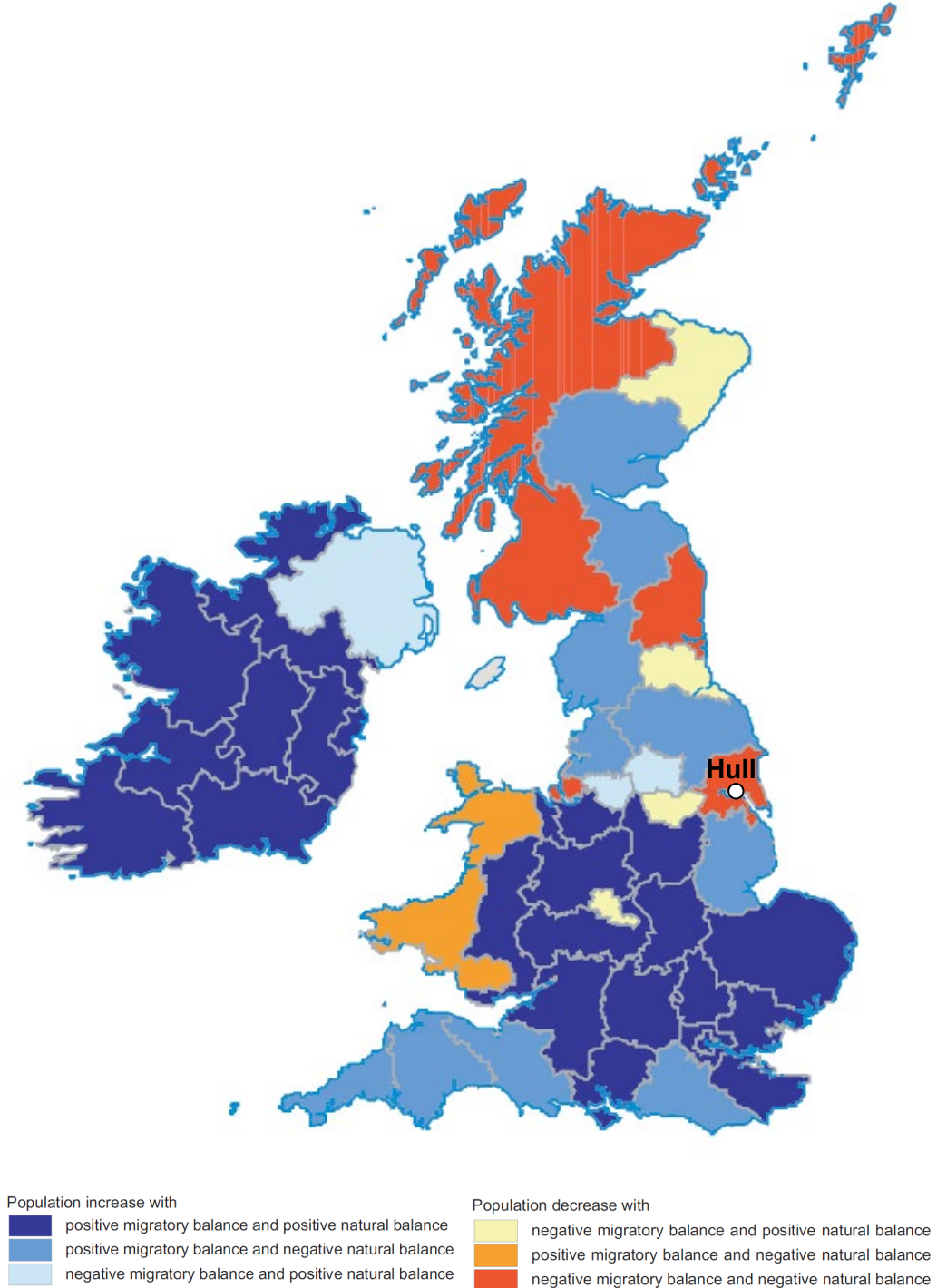- negative migratory balance and negative natural balance

Figure 3: Change in population, 1996-1999: main components (European Commission 2004)

After the sharp decline in population and employment, regeneration projects mentioned by interviewee #3 have managed to put a brake on the high emigration and negative natural balance.

People in charge have attempted to overcome the problems to have a better future for their city. There are investments for a digitalised Hull and improved opportunities to create a better future for the city while taking advantage of the events (University of Hull, 2018). The Digital Smart City projects are progressing for the future of Hull, intending to create a better livelihood, providing employment opportunities and a digitally connected city (Hull City Council 2018a). These projects are being planned to benefit the citizens of Hull and help the growth of the city in a social and economic context (Jennison [No Date]).

Developing a smart city initiative in a declining city requires dedication and a clear understanding of technology usage and digitalisation. Developing smart city initiatives is crucial for the cities that have faced or are facing decline due to a limited economy and lack of opportunities. All actions should have a positive impact or minimise existing problems. Otherwise, it might worsen the situation, which is already not ideal.

The starting point of smart city development projects in Hull has been discussed with the interviewees to understand their pathway. As stated by interviewee #3, the council decided to adopt smart city initiative and invest with ambition. This ambition of the Hull will be supported as Barrow (2015) states, "to be recognised as the UK's leading Smart Sustainable City through realising the full potential of digital technology and connectivity for the benefit of all of Hull's citizens and business". Council planned to build on a robust system. One of the core ideas in Hull is to create SmartOS and function it as a brain where each data can be connected digitally, future projects can be connected, and data is processed by technology to access relevant and necessary data.

Governing of the Hull has been emphasised through the principles stated by Anderson ([No Date]);

"1. Establish a clear, compelling and inclusive vision for the city;

2. Take a citizen-centric approach to all aspects of service design and delivery;

3. Enable a ubiquitous, integrative and inclusive digitisation of city spaces and systems;

4. Embed openness and sharing in the way the city works. "

All four of these principles theoretically can overcome the decline by improving inclusivity and livability of the city, prioritising citizens, being transparent in policies and an integrated city. Given that the principles are for the future projections between 2018-2023, data that has been collected through interviews will be explored in the following section to explore whether they fit with the determining principles for improvement.

A broad conclusion comparing the excessive decline of Hull in Figure 3 and a reduced emigration in Figure 4 will reflect that the digitalisation and planning projects has slowed down rapid depopulation.
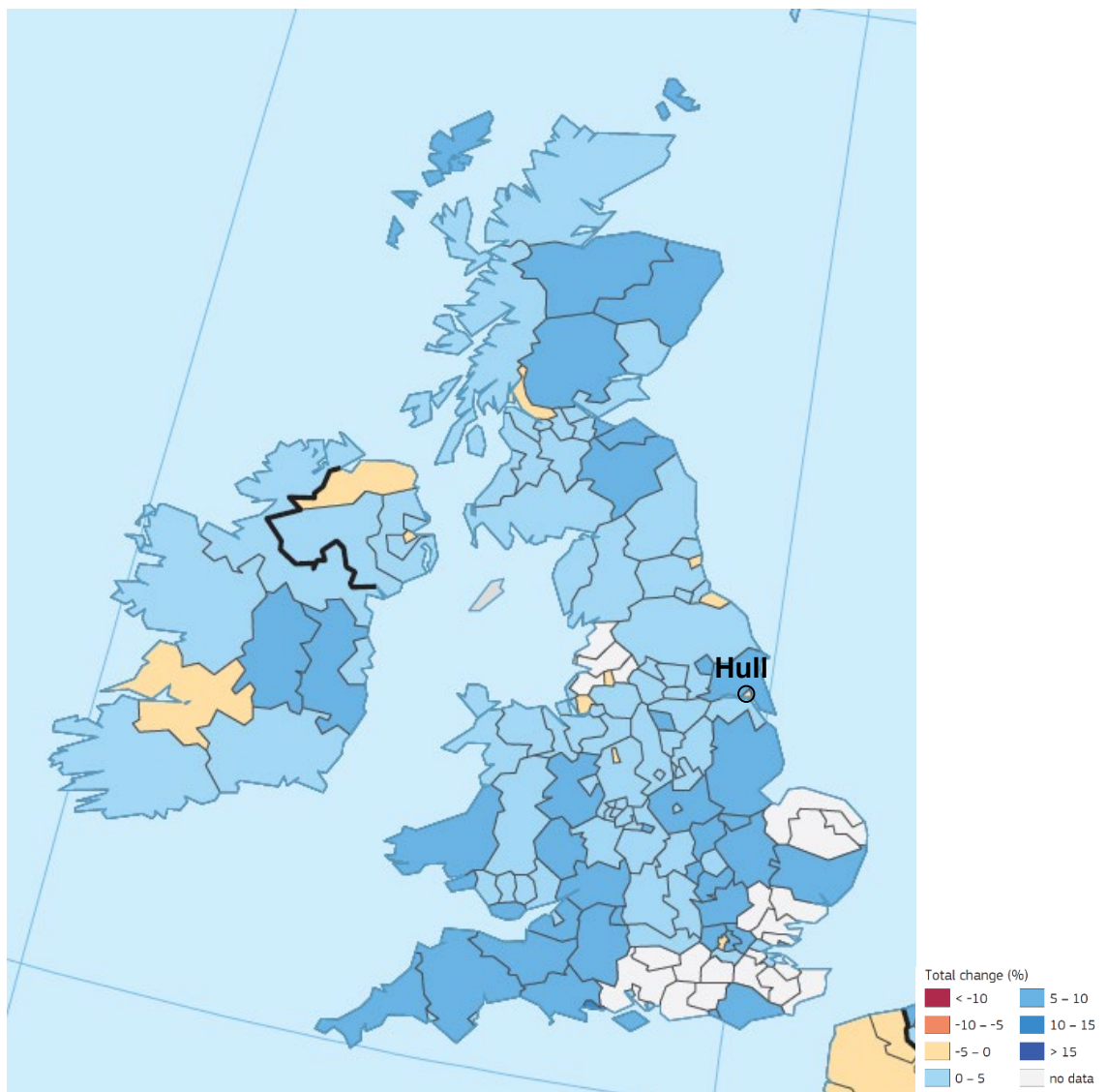

Figure 4: Net migration in regions: 2005 – 2015 (European Commission 2017)

4.2 Implementation and Impacts of Smart City Technologies

Implementing smart technologies in a city relies on the usage of sensors, gathering data with IoT and using AI to start machine learning to create an understanding of the data. As mentioned by interviewees #1 and #2, "anyone can place sensors around the city and connect them with IoT, but in the end, what matters is that how you use that data." It reflects the importance of controlling the technology and critiquing and understanding the data to convert it into an optimum planning policy. The smart city projects in Hull related to the usage of intelligent technologies and the outcomes of gathered and processed data through those projects will be explored in the following section.

Presented by interviewee #3 and summarised in Anderson ([No Date]), Hull has adopted eight key themes to achieve a smart sustainable city for the future, "connectivity, digital services, open data, procurement, business environment, education, digital inclusion, security". Smart city projects in Hull are expected to follow these themes.

4.2.1 Full Fibre Cover

Full broadband coverage was one of the starting points in Hull. Unlike other cities in the UK, Hull has had only one company, until recent years, to offer broadband which was KCOM (Interviewee #3). Despite seeming a disadvantageous situation, the council converted it into an advantage by providing %100 full-fibre broadband coverage. To create a strong base for smart city technologies and digitalisation, it is undeniable that broadband coverage is crucial. Beyond its importance for connecting smart city technologies, broadband speed and coverage are beneficial for students, start-up companies, businesses, and remote workers. During the COVID-19 pandemic, the value of having an impressive broadband infrastructure has been realised more than ever. Jennison and Bullock (2020) stated that Hull can be an ideal base for remote workers and freelancers due to having high-speed full-fibre broadband coverage in every part of Hull and considerably more affordable rentals.

Given the circumstances, it reflects that the starting point of the smart city process with full-fibre cover is ideal for technological investments by the council, public sector and start-ups. Beyond any planned projections, having a comprehensive broadband network offers flexibility at an unexpected event such as the COVID-19 pandemic.

4.2.2 Smart Bins

Interviewee #4 pointed out that the "usage of the smart bin is one of the most common projects related to smart cities." It can be related to the easiness of placing sensors mentioned by interviewees #1 and #2. Another reason for the implementation of smart bins in smart cities can be due to having multiple benefits. The smart bin sensors increase the work efficiency of waste and recycling collection teams by providing accurate data. This efficiency leads to optimising of collection truck routes and helps reduce carbon emissions and fuel usage.

It is a simple solution to achieve sustainability by reducing emissions and increasing resource efficiency for waste and recycling collection teams. In this perspective, smart bins in Hull are vital for reducing costs, using resources efficiently and contributing to sustainability which are well suited with the agenda of overcoming the decline.

4.2.3 Fleet Management

Council fleets are a crucial part of public service and infrastructure works globally. However, because most of these fleet vehicles are fossil-fuel based and considerably occupy a larger space, they have undesired impacts on the city. Hull has adopted a holistic fleet management system to monitor vehicle fleet routes, carbon emission, and fuel consumption, serving within the council organisation (Interviewee #1 and #2; Interviewee #3). It has the aim of "optimising the routes and reducing carbon emission" (Interviewee #1 and #2). The data gathered through monitoring has the possibility to help the "council co-ordinate and manage the vehicle fleet it uses efficiently" (Anderson [No date]). Effective usage of vehicle fleets can improve the sustainable usage of council resources and sustainability of the environment by lowering carbon emissions and fuel usage.

Despite having a more holistic approach, fleet management has similarities with the smart bins project. Therefore, instead of separately financing and planning similar projects, it might have been more relevant to integrate such similar projects to increase efficiency by implementing smart city projects, saving time, and reducing investment costs.

4.2.4 Air Quality Sensors

Air quality sensors are being used by the Hull council to measure pollution levels and collect data regularly (Interviewee #3). The data produced from air quality sensors are being sent to the system, and through interpretation, it will provide information for the citizens to be prepared regarding the air quality (Interviewees #1 and #2).

Monitoring the air quality will present the effectiveness of other smart city projects, especially for the smart bins and fleet management in which the aims are to reduce carbon emissions and fuel consumption. Besides smart projects, air quality sensors will provide information about pollution levels in specific areas. Then these areas will be focused on by authorities to understand the reason for pollution and offer solutions. Due to being easy to install, which can even be integrated with the smart bins (Interviewee #3), air quality sensors are simple but powerful.

Having the flexibility of integrating with other projects increases the efficiency of this project. As critiqued for the fleet management and smart bins system, exploring possible integration between smart city projects can evolve and become more efficient.

4.2.5 Transport Systems and Mobility

Similar to many other smart city projects, by the use of technological equipment, traffic data will be gathered. Providing necessary information to citizens about traffic congestions, public transportation schedules, and routes is essential and one of the most commonly used information worldwide (Interviewee #4). Adding up to pieces of information provided to citizens creates a space for digital applications to be found by entrepreneurs, which will support the aim of providing open data.

4.2.6 Conclusion

In conclusion, technological improvements and projects mentioned above promise to improve the life quality, contribute to sustainability, create new employment fields, provide a better infrastructure to become more attractive and overcome the declining situation. Even though the impacts of smart city initiatives over the city can be seen through information provided to citizens and improved opportunities in everyday life, interviewee #3 mentioned that to achieve positive impacts from smart city implementations are not as immediate and needs more time to be more effective.

4.3 Data Usage, Connectivity and Citizen Integration in Hull

Smart city projects in the previous sections are examined individually. These projects can reflect a small portion of outcomes through digitalisation. Through interpretation of document analysis and interview data, it can be stated that a city can adopt particular smart city projects. However, a smart city should be approached as continuous progress; therefore, it requires a system to gather all the data and should have the option of being able to connect with future digitalisation projects. Then, all the related data can be examined and studied by authorities to create better planning policies.

The data usage and collection in smart cities are considered causes for contradictions relating to citizen rights. There are ethical responsibilities over the council and technology companies, and they strictly need to be aware of the situation during the whole process (Sholla S et al. 2017). It is essential to provide transparency for the citizens because they are a part of the system, and they have the rights within their digitalised city (Kitchin et al. 2019). These points need to be considered in implementing smart city initiatives in declining cities. It is crucial to have citizens in a position where they trust the authorities to implement digitalisation more efficiently, as "it takes a long time to build up trust, and it is very, very easy to lose trust" (Interviewee #3).

A holistic approach to creating a digital layer and connectivity in Hull about data usage is potentially advantageous However, considering citizens' data privacy and security, trust should be guaranteed between the digitalised city and its citizens. As Sholla et al. (2017) summarised, "The secure and ethical use of this data must be a top priority within every project".

4.4 Smart OS

In Hull, the system that gathers the data and connects digitalised projects is "SmartOS". It has the ambitious goal of integrating systems with IoT. The smart city plan of Hull aimed to create this connectivity in innovative technologies by planning for digital infrastructure (Barrow 2015). It then leads to a complete holistic approach with the development of Hull SmartOS to relate all technologies within the system, and demonstrated by the Hull City Council (2018a). Hull City Council has supported their smart city developments with new investments for the city with an improving digital connectivity phase of digital investments. This digital strategy is aimed to help inclusive

growth of Hull and stop the declining situation with a long term vision for citizens by providing sustainable development and abundant opportunities (Hull City Council 2018b).

The importance of gathering and connecting the data has been emphasised. The positive and negative impacts of connected systems have been discussed and examined by reports and researches over "e-governance" (Alshuwaikhat and Nkwenti 2003; Grimsley and Meehan 2007; Cordella and Iannacci 2010; Deng et al. 2018; Devenyi et al. 2019). These researches have been performed in various perspectives such as; developing countries, developed countries, citizen involvement and public sector usage.

SmartOS will be examined as a source for e-governing the system for the future. It acts as a focal point where data is gathered and processed. Beneficial usage of dataset outcomes on SmartOS will increase the future integrations of the citizens and city.

4.5 Smart Sustainable Futures: Resilience

Due to the impacts of climate change, resilience is becoming a focal point in cities that are at potential risks. Hull is in a high flood risk area, and in the long-term, people are suffering from household damage, having economic difficulties in recovering and being affected mentally and physically (Ramsden 2018). The survey report has been completed by Ramsden (2018), and the living with the water initiative aims to find and offer appropriate solutions for the problems of the citizens. This is one of the most critical topics in the case of Hull regarding resilience.

Besides natural disasters, unexpected events such as "COVID-19 has demonstrated the importance for cities to be more flexible and to develop resilience" (Golubchikov 2020). It has been discussed with all interviewees and explained by forwarded documents of academics to understand how to achieve that flexibility. Hull has been planning to improve resilience and focusing on improving their proactive approach to offer flexibility to their citizens with technological implementations. It has been discussed by Jennison and Bullock (2020) that the existing smart city projects In Hull are capable of offering solutions for COVID-19 by providing optional remote working conditions and affordability in rental prices. Once again, it reflects the importance of having a strong foundation with technological inclusivity. Even though it

is valid for offering flexibility during the COVID-19 pandemic, technological improvements should play an active role in permanent problems such as Hull being the second-highest flood risk area in the UK.

Therefore, improving the resilience of a city creates a feeling of security for people who have been suffering from natural disasters (Ramsden, 2018). In the current conditions, there are policies and principles adopted to provide resilience for floods (Hull City Council 2017; Hull City Council [No Date]), which are still in need of improvement for better resilience. In the context of sustainability, the need for resilience in a city has increased by the effects of climate change. Therefore, the steps for improving sustainability, which is discussed in the literature review and previous sections, gain more importance. By providing sustainability, cities can reduce carbon footprints and slow the grim impacts of climate change. This will give authorities time to develop and implement technologies properly for achieving a resilient city.

4.6 Conclusions

Hull City Council (2018a; 2018b) brings insight from the policymakers and how they planned the whole process, while the University of Hull (2018) supports the improvements within the city on the report explaining digital and other investments. These reports published by the responsible institutions create a base for the interviews and help keep the focus on the details. The data and speeches were given by Barrow (2015), and Anderson ([No Date]) will be reflected in conclusions and recommendations.

Out of the interview, documentary analysis and literature data, simplified SWOT analysis for the city of Hull can be presented in Table1 below. It simplifies the main topics that have been interpreted from the sources.

Strengths	• Strong cultural background • Citizens being proud of their city
Weaknesses	• Loss of employment and opportunities • Limited budget and lack of funding
Opportunities	• Room for improvement and development • Need for investments and regeneration
Threats	• High flood risk area • Depopulation

Table 1: SWOT analysis of Hull, interpretation of data collected during interview and documentary analysis

As specified in the methodology chapter, a valuable way of critiquing the SWOT analysis will be through BEEM analysis based on digitalisation options. Critiquing the SWOT analysis data can create a comparable outcome with the ongoing projects that are dealing with Hull's problems. By doing that, Table 2 presents ideas that will be put in action to respond to the needs. Recommendations in the following chapter will be presented by using the data simplified in Table 1 and Table 2,

How to "Build" on STRENGTHS	• Prioritising the citizens and implementing digitalisation progress according to their needs. Keeping infrastructure and publics services up to date for citizens. • Giving importance to maintaining the city and preserving existing strengths.
How to "Eliminate" Weaknesses	• Providing a proper environment for businesses and new investments with accomplishments such as full-fibre coverage and open data sharing. • Implementing cost-efficient systems to increase efficiency, control budget and reverse the economic recession.
How to "Evaluate" Opportunities	• Attracting people by providing a stable situation through the digitalisation of the city. • Preparing planning policies that can adapt to the future and evolve with the needs of the city by the flexibility that smart cities can offer.

How to "Minimise" Threats	• Implementing sensors to monitor risks and speeding up the response time of authorities. • Improving the life quality and opportunities to slow emigration and stabilise the population.

Table 2: BEEM analysis over the SWOT analysis of Hull

CHAPTER FIVE | CONCLUSIONS and RECOMMENDATIONS

5.1 Introduction

Following the examination of the data and discussions, final conclusions will be expressed in this chapter. To sum up, this research has presented a review of the literature related to declining cities, smart cities and sustainability. A literature critique aimed to develop an overall understanding of the subject and provide a basis for analysing and interpreting the data. Subject relevant information gathered by using the case study method and collecting data through interviews and document analysis. The interpretation and analysis of the collected data aim to answer research questions by following the objectives. In the beginning part of this chapter, a brief summary of the previous chapters will be presented. Then, the limitations and outcomes of the research will be explained. In the final part of the last chapter, a recommendation for future researches will be provided by considering the limitations and outcomes,

5.2 Research Findings

In this section, research findings will be presented through research questions.

- **How can digitalisation progress be held for a declining city?**

Through research data, it has been understood that implementing the digitalisation process to achieve a smart city depends on various parameters within the city. As mentioned in the research problem section, discussed with interviewee #3 and interviewee #4 and examined through literature review, most of the smart city projects that are going on have been implemented in wealthy and globalised cities, and these cities have been using smart city projects to show off. On the contrary, implementing a smart city initiative in declining cities needs to be more efficient than implementing in a global city due to limitations, problems, and citizen expectations.

In Hull, the smart city projects have started within the general approach of regenerating the city, especially after the first decade of the 21st century. While there were traditional planning projects for improvement, the smart city initiative has started with a dedicated agenda to make it one of the leading smart cities in the UK (Barrow 2015). Hull Council has adopted a progressive approach and evolved the digitalisation process through time.

Research findings have shown that financing the smart city initiative in Hull was limited due to a lack of funding. When the circumstances considered back in the

beginnings of the smart city initiative, lack of funding could have been caused the termination of the smart city project. An important advantage and chance that Hull had was the willingness of the council to continue the smart city approach and have Connexin, a local partner, collaborate in the digitalisation process. Interviewee #3 stated that Connexin had been chosen as the partner due to having the best offer, and being a local company increased the communication speed by the advantage of situating at the same area as mentioned by interviewees #1 and #2.

To conclude, a smart city initiative needs a strong foundation, such as the broadband coverage example in Hull, that will be maintained through development and provide basic needs for implementation of technologies. Building on top of that, integration of cost-efficient systems and using the benefits of ICT, IoT and AI is crucial to keep up with the technological improvements globally.

- **What Smart City technologies are being used, and what impacts do these technologies have over the city of Hull?**

Smart city projects in cities worldwide have common points due to the similarities in between problems of cities globally. In the case study of Hull, projects of smart bins, fleet management, street lights, traffic management, air quality sensors and full-fibre cover are explored. These projects are relied on the usage of sensors, connecting through ICT, and IoT and outcomes are optimised with the help of AI and machine learning. All the data that are being collected are connected to each other in a digital layer, accessible through open data and presented in SmartOS. The impacts of it can be explained for citizens, businesses and the authorities. Open data provides transparency in the implementation of policies, which integrates citizens more with the city and builds trust. Citizens also benefit from the interpretation of data that will be converted into solution-based projects for problems detected through data. As interviewee #3 stated, open data and sharing of knowledge are essential benefits for the businesses due to them accessing the processed and visualised data.

When all of the systems are working together and integrating different aspects of a city, it will be expected to keep a standard for the city, improve the livability and attract people to overcome the decline. Also, it will contribute to the citizen life, improve sustainability and create a suitable background for innovations.

Moreover, Hull's responsive smart systems, which aim to have a proactive approach in the event of weather conditions, natural disaster risks, and predictable actions, will prepare the city before being handed for an unexpected event and alarm the responsible bodies to be prepared with extra caution. An example of it will be informing the police, NHS and fire department by using all connected digitalised layers in the city when there are extreme conditions, as mentioned by interviewee #3. This connectiveness helps improve the resilience of the city during unexpected events such as floods or COVID-19.

- **How can citizens integrate with smart city tools considering their rights to the city?**

Considering citizens and their relation with the city is a vital point not only for smart cities but also for all urban planning approaches. Despite being critiqued for most urban planning approaches, citizen involvement and their rights to the city are more contradictory topics in smart cities due to continuous data collection and usage (Kitchin 2016; Anthopoulos 2017a). Critique and commentary of citizen rights in the literature have generated fruitful debates in the discussion of smart city initiatives and will lead to ideas for improving the offered services for citizens.

Regarding citizen safety and privacy concerns in smart city projects in Hull, interviewees #1 and #2 and interviewee #3 have stated that the datasets gathered through sensors and cameras in Hull are not people-centric, which minimises the concerns. Minimising the concerns for privacy and usage of not people-centric data on behalf of citizens helps build trust between the city council and citizens. Gaining the trust of the citizens is necessary to increase the willingness of citizens to participate in city development. However, "It takes a long time to build up trust, and it is very, very easy to lose trust" (Interviewee #3) so sustaining the trust is a crucial matter for the council.

The ways of citizen integration in a digitalised Hull varies. Citizens have the ease of accessing processed data to plan their time efficiently. Also, each citizen is an essential part of the smart city system due to providing non people-centric data and contributing to the system. The integration of citizen creates a mutual relation between the city and the citizen when the authorities respect privacy and personal data

- **How will a Smart City project lead to sustainable city development?**

After discussing the first three research questions, progress has been leading to exploring sustainability options within a digitalised declining city. Smart city projections and aims presented by (Barrow 2015; Anderson [No date]) emphasise the projects and possible outcomes. Supported by the ideas stated by interviewees, the digitalisation of the city provides a more efficient use in different contexts.

Becoming more efficient brings the situation of Hull one step forward according to the existing situation. In specific examples, smart bins, fleet management, air quality sensors and street lights contribute to environmental sustainability by reducing unnecessary use of electricity, consumption of fuel and excessive carbon emission. Data that has been collected from monitoring and tracking systems and non people-centric data provides visualisation of smart data for citizens through applications about the bus schedule, traffic and predictions, which is improving sustainability in social context by an improved amount of options. Another context that could be mentioned is the economic context. Investing in broadband and fully covering Hull by high-speed internet could be mentioned as the foundation of the smart city initiative of Hull. Supporting broadband coverage with access to open data and providing ideal grounds for businesses reanimates the economic cycle, and digital investments will be increased through the digitalisation of the city.

5.3 Recommendations

The present research reviewed the literature with a critique and interpretation and analysed the data that has been gathered through adopted methodologies. Based on the overall outcome, research emphasised the ways of improving the situation in declining cities. Through findings and a critical approach of what is relevant to the research topic, what is missing in the research and possible opportunities that could be achieved within future researches, recommendations will be provided for decision-makers and future researches.

5.3.1 Recommendation for Decision Makers

A better understanding of the process of smart city governing in declining cities has been drawn through outcomes of the case study in Hull and interviews with professionals in smart city development. Implementing smart city projects have been

critiqued and challenges discussed. Possible improvements according to reviews from a different perspective can be summarised as follows:

- Smart city initiatives are quite risky due to contradictions mentioned in literature and safety concerns. Therefore it is essential to adopt a transparent policy that values citizens and involves them in the planning phase.

- Advanced technology has shaped our lives with its benefits and contradictions, and now it is up to shape the places we live. It is undeniable that there are topics that should be concerned. However, it brings great opportunities. Instead of using technology as a show-off, which was criticised during interviews and literature, it should be revisited as a supportive tool for innovative and traditional planning policies.

- Either using smart cities or any other term, digitalisation needs more examination and experiments. Through time, it has the potential to provide a sustainable and resilient future for us with ideal outcomes.

In general, it is recommended to integrate innovative solutions in pilot parts by being as inclusive as possible to seek out fruitful feedback from the real users, the citizens whom the decision-makers should be prioritising in policies. Then smart cities can be studied better and expected to be idealised.

5.3.2 Recommendation for Future Researches

The main topics explored in this dissertation are declining cities, smart cities and sustainability, and the research focuses on the integration of technology in declined cities, what lacks present in the literature, to find out the possibilities behind it. The research mentions topics such as; citizen rights, governance, technology and data usage, sustainability and resilience. However, there is still a need for more relevant data, in-depth interpretation, and a long-term examination of the topic. To improve the research opportunities and strengthen the literature related to the subject;

- Different methodologies can be adopted, or new parameters can be added to existing methodologies to reveal another perspective to this study. For example, this study focuses more on the governing and authority perspective and reaches statistical data through the official report, but a series of interviews or questionnaires can be performed with people who are emigrated from the city and migrated to the city to widen the point of view.

- More declining cities, which have smart city initiatives, can be added to comparison, and "what if" questions can be discussed with authorities of declining cities in different countries. During the research, interviews and contacts have been made with people who have experience with smart cities outside Hull to achieve comparable data, but it is open for improvement and can add value to the research by having different contexts.

- Research context can be extended to developing countries and connected with UN SDG. Therefore approaching smart cities as a tool for development can be examined in a vital context.

In short, the research aims to reach outcomes for reducing what negatively impacts the people living in deprived and declined areas. Citizens of each city in the world deserve better living conditions and opportunities, and this research subject is hoped to raise a critical approach in the development of declining areas by future researches through the guidance of recommendations.

5.4 Final Thoughts

It has been aimed to answer research questions and find out possibilities within the research topic, considering the resources examined during the research. The case study concludes that implementing a smart city initiative in a declined area is possible and will be carried out by the local authority.

It is seen that the development of a smart city and evaluation of the process requires an essential amount of work and time. To achieve concrete results, patience and keeping in line with principles are crucial. Research has found that there are benefits and positive impacts as a result of smart city developments; however, they will not magically solve each problem and need time to integrate with the city and citizens comprehensively.

Finally, having a strong and dedicated case of Hull will lead other declining cities to adopt smart city strategies that will improve their situation. Through a chain reaction and experiment of using smart city initiatives, it will then offer more realistic solutions for the problems of declining cities.

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APPENDICES

Appendix A: Interview Consent Form

<u>Cardiff University MSc Dissertation – Interview Consent Form</u>

I am a postgraduate student at Cardiff University studying International Planning and Urban Design. For my dissertation, I am studying the topic of *"How Can Smart City Development be Used to Improve the Situation of Declining Cities: Examining the City of Hull"*.

My aim with this research is to explore comprehensive account for the declining cities and critiquing iteratively whether Smart City developments provide convenience to improve the habitability, opportunities, protection of resources, sustainability, resilience, and preservation of that city by using Smart City technologies with AI and Internet of Things (IoT). The research will consider the Smart City projects at Hull using the case study approach. Interviews will be used as a methodology to achieve research aims. Interviewees will be professionals and academics recruited within the Hull City Council, Connexin and related parties who are leading the Smart City development projects in Hull and have relevant knowledge about this topic.

Interview details and data collected through transcribed interviews will only be used for this specific dissertation and will not be shared for any other purpose. Interviewee statements will be cited anonymously in the research. Interviews will be recorded by the online meeting software used and transcribed with the agreement of the interviewee.

Interviewee Name:

☐　　I have been informed about the dissertation topic and aims before agreeing to be interviewed

☐　　I am aware that the interview will be recorded and transcribed to be used as data for the dissertation

☐   I am giving consent for my answers to be used by Selami Sungun for his dissertation

☐   I am aware that I can make changes to this consent form if I change my mind

If you have any questions or want to change your consent, please contact me via sunguns@cariff.ac.uk

I am thankful for your kindness to accept my interview request and give your time to help develop my dissertation project.

Signature: **Date:**

Appendix B: Interview Questions for Target Group 1

Question	Related Research Questions
Are smart city initiative developed in relation to traditional projects?	*How can digitalisation progress be held for a declining city?* *What Smart City technologies are being used, and what impacts do these technologies have over the city of Hull?*
How did the Hull City Council start smart city initiative? Was there a funding?	
Is this a permanent city vision, or a temporary approach?	
What are the governing processes, was there any policy changes to implement smart city initiave?	
How council approaches to data, proactive or reactive? How is the data being collected?	
Is there any businesses or start-ups developing applications through open data?	
How are the different age groups integrated within the city?	*How can citizens integrate with smart city tools considering their rights to the city?*
Do citizens involved in the process (feedbacks, proposals) or is it a top-down project?	
How citizen rights are protected in the collected data?	
Do you consider UN SDG while planning the smart city projects?	*How will a Smart City project lead to sustainable city development?*
In which ways can we see an improvement as a result of smart city initiative in Hull? If not is it possible to see in near future?	

Appendix C: Interview Questions for Target Group 3

Question	Related Research Questions
How the collaboration between Connexin and Hull City Council is has started?	*How can digitalisation progress be held for a declining city?*
What are the obstacles of implementing technological elements in a considerably smaller economy?	
What are the benefits and disadvantages of centralizing data in SmartOS?	*What smart city technologies are being used, and what impacts do these technologies have over the city of Hull?*
Which tools are being used by technology companies?	
What are the next steps, which new smart city projects will be involved in the system?	*How can citizens integrate with smart city tools considering their rights to the city?*
How is the collected data being used considering citizen rights?	
Was sustainability a concern for the future of Hull smart city projects?	*How will a Smart City project lead to sustainable city development?*
Is it possible to achieve a sustainable future in related contexts (economy, livability, environment, resource efficieny) with Smart city developments and IoT?	
What are the next steps, which new smart city projects will be involved in the system?	

Appendix D: Interview Questions for Target Group 4

Question	Related Research Questions
How can a smart city approach differentiate in a declining city from a global city?	*How can digitalisation progress be held for a declining city?*
Why are smart cities being used for showing off?	
How should smart city initiatives should be used for the future of cities?	*What Smart City technologies are being used, and what impacts do these technologies have (over the city of Hull)? ---Due target group being professionals out of Hull, answers related to general context and reflected over Hull.*
What could be the possible positive impacts of smart city projects in declining areas?	
Benefits and importance of mobility analysis with data monitoring in smart cities?	
What do you think of citizen rights and privacy in smart cities?	*How can citizens integrate with smart city tools considering their rights to the city?*
Is it possible to achieve sustainability in smart cities	*How will a Smart City project lead to sustainable city development?*

Appendix E: Commentary – Impacts of COVID-19

During the dissertation, COVID-19 has effected the research in different phases. For the methodology, a field study method has been stated in the ethical approval form with mentioning if there will not be any restrictions and unexpected events due to the COVID-19 pandemic. Also some interviews were hoped to happen face to face if ever there was a field study. Due to getting vaccinated later than expected and getting sick afterwards, I did not want to risk neither myself nor someone else by travelling with multiple changes. It also has effected the recruitment process for the interviews. Even though having the option of online interviews made it easier to complete interviews, part of the contacts did not have any availability due to their breaks and intense schedule afterwards. Despite all unpleasant impacts, contacts who could not accept to be interviewed due unavailability in their schedule have sent documents they have presented before related with the topic. Unfortunately, negative impacts of COVID-19 has been present during the dissertation with the exhaustion caused by restrictions and sickness. Even though some lack of completing desired methods and other impacts, dissertation has been completed with an ambition to provide a paper that discusses the presented research topic and provokes ideas.

CARDIFF UNIVERSITY SCHOOL OF GEOGRAPHY AND PLANNING

Ethical Approval Form

<u>Student Projects (Undergraduate & Taught Masters)</u>

When undertaking project and dissertation research, you must comply with Cardiff University's Research Integrity protocol. This is why it is essential that you complete this form.

It is **YOUR** responsibility to discuss your research ethics with your supervisor, and to submit this form to them at least **TWO WEEKS** <u>before you intend to start any data collection</u>. Before you start collecting any data, **your supervisor must sign it off** (this can be using an electronic signature). You must keep a copy for your records, and submit it as part of your final dissertation. **Any data collected without ethical approval cannot be included in your dissertation.**

All research involving human participants or data must have ethical approval. If making use of information about human participants that is publicly and lawfully available e.g. census data, government population statistics, personal archives held in public libraries etc you must still complete this form to demonstrate your engagement with the university's research integrity strategy.

Before completing the form, you must read through the following guidelines and sign to indicate that you have understood them.

Recruiting Research Participants

All participants in your research must enter into it freely and willingly. They must know and understand what they are agreeing to by taking part. Participants must not be put under duress to participate and should be made aware that their involvement is entirely voluntary. Refusal to participate will have no consequences and they will not be required to provide a reason.

If they do agree to participate, they are free to withdraw at any time without providing a reason. If required, anonymity and confidentiality must be maintained throughout the research process.

Information Sheet and Consent Form

Informed consent requires giving sufficient information about the research to ensure that potential participants can make a clear and informed decision about whether to take part. This should be supplied in written form (the 'information sheet') and signed off (the 'consent form') by the research participant and researcher. The key idea is to conduct your research openly and transparently.

The information sheet should make it clear that this research is for a student project. It should be written in an accessible way so that a member of the general public can easily understand it. The information must be accurate,

concise and appropriate to the socio-cultural context in which it is being given. You must give participants sufficient time to read, process, and consider their participation, as well as ask any questions. You should also consider whether they will be able to engage with a written document and consider how you may deal with problems of illiteracy or when engaging with people for whom English/Welsh is not their first language.

Examples of information sheets and consent forms will be provided but can be adapted to the specific requirements of your research. They should include:

1. the name of the researcher(s)
2. an explanation of what you, the researcher, is hoping to achieve by the research
3. what is going to be done by you, the researcher
4. an explanation of the risks, pain or discomfort, if any, that the participant may experience
5. a clear explanation of what the participant is expected to do during the study
6. a statement that the participant is not obliged to take part, and may withdraw at any time
7. contact information for you and, where applicable, your supervisor
8. consent statement (this can be separate to the information sheet)

If applicable, a copy of your consent form and information sheet must be included with your ethics form.

Whilst these guidelines are not exhaustive, they indicate a set of obligations to which students should adhere. Responsibility for both interpretation of, and compliance with, these guidelines rests with the student.

Declaration

☑ I have read the above information and agree to abide by it in my research practices.

☑ I understand that I should be willing to answer any questions from potential participants.

☑ I understand that consent is only valid for procedures set out on the information sheet. Should any of the information change during the course of the study, new consent should be sought; participants are free to refuse consent and withdraw from the study if they wish.

☑ I understand that I must be clear as to how far I can afford participants anonymity and confidentiality, and that they have a right to refuse being recorded.

☑ I understand that I must be clear as to whether participants will be able to see and amend interview transcripts and other research materials.

☑ I understand that I must take appropriate measures to store my research data in a secure manner and retain it according to the university data retention guidelines.

☑ I have read and understood the data protection guidelines and will keep data securely during any travel (either on an encrypted device or in a locked case, if in paper form).

☑ I will take all reasonable steps to ensure that no physical, social and psychological harm comes to participants through their participation in this research.

☑ I understand that any data collected that falls outside of the research design/methods presented in this form cannot be used, analysed, or published and must be destroyed. This means that it cannot be included in the dissertation.

Name: Selami Sungun

Signature:

Date: 24/07/2021

Title of Project: How Can Smart City Development be Used to Improve the Situation of Declining Cities in the UK: Examining the City of Hull

Name of Student(s): Selami Sungun

Name of Supervisor/Module Leader: Dr. Oleg Golubchikov

Degree Programme and Level: MSc International Planning and Urban Design

Proposed dates of field work: 16/08/2021 - 24/09/2021

Date: 24/07/2021

Dissertation Summary:

Please provide a concise, general description of your dissertation project (<200 words).

The dissertation will focus to explore whether it is advantageous or disadvantageous to have a Smart City Development in declining cities. Usage of different technologies in a Smart City development will be examined to understand their affects. During the research, the changes provided by these technological applications over the topics such as; sustainability, livability, citizen rights and resilience will be studied. The research and data collection will show different perceptions to the subject by a study of Hull City in the UK.

What are the research questions?

1. How can digitalisation progress be held for a declining city?

2. What Smart City technologies have an impact on the city of Hull?

3. How can citizens integrate with Smart City tools considering their rights to the city?

4. How will a Smart City project lead to sustainable city development?

Who are the proposed participants?

To understand the planning phases and developments within the Smart City project, interviews will be held with the planning authorities, academics and companies that took part in the process. Proposed participants are;

-Hull City Council Smart City Project Leaders

-University of Hull Urban Researchers -Connexin Company

- Hull SmartOS Project Coordinators

How will the participants be recruited?

Participants will be contacted via mail to meet in person or online.

What sort of data will be collected and what methods will you use to do this?

The main source of data will be qualitative. In need of any detailed statistical data, there will be use of quantitative methods.

Qualitative data will be collected by interviews and document analysis. Interviews will be recorded and transcribed with the consent of interviewees for analysis.

To show whether if there is an improvement or not considering topics such as; livability, sustainability of the city and opportunities, government and council sources will be used as quantitative data.

To emphasize the changes happened by the Smart City Projects and related developments, personal commentary will be made using the photos and information gathered during a possible field visit. This can be done by using the Smart City applications in the city during the visit and examining what they are offering to improve the life in Hull.

Where are you undertaking this research?

If there is not any restrictions at the time of field work, it will be at Hull, UK.

All ethics forms should be completed in discussion with your supervisor. If you tick 'Yes' in any of the red boxes below, your supervisor may refer your project to the School Ethics Committee (GandPEthics@cardiff.ac.uk) if they deem it to be of significant concern. They will review your project and proposed responses, working with you and your supervisor to address any potential, outstanding ethical issues. Only once these have been resolved, can your supervisor sign off the research (this can be an electronic signature). You should include a signed copy of the completed form as an appendix to your submitted dissertation.

If you subsequently change your methods, you must re-submit an updated ethics form before you collect your data.

Recruitment Procedures:

		Yes	No	N/A
1	Does your project include children under 18 years of age?		✓	
2	Does your project include people with learning or communication difficulties?		✓	
3	Does your project include people in custody?		✓	
4	Is your project likely to include people involved in illegal activities?		✓	
5	Does project involve people belonging to a vulnerable group, other than those listed above? Please provide details in the box on p6.		✓	
6	Does your project include people who are, or are likely to become your clients or clients of the department in which you work?		✓	
7	Does your project include people for whom English / Welsh is not their first language?	✓		
8	Does your project include field research outside of the UK?		✓	

Consent Procedures:

		Yes	No	N/A
9	Will you tell participants that their participation is voluntary?	✓		
10	Will you obtain written consent for participation?	✓		

1[1]	If the research is observational, will you ask participants for their consent to being observed?	✓		
12	Will you tell participants that they may withdraw from the research at any time and for any reasons?	✓		
13	Will you give potential participants a significant period of time to consider participation?	✓		

Possible Harm to Participants:

		Yes	No	N/A
14	Is there any realistic risk of any participants experiencing either physical or psychological distress or discomfort?		✓	
15	Is there any realistic risk of any participants experiencing a detriment to their interests as a result of participation?		✓	

If there are any risks to the participants you must explain in the box on page 4 how you intend to minimise these risks

Data Protection:

		Yes	No	N/A
16	Will any non-anonymised and/or personalised data be generated and/or stored?	✓		
17	Will you have access to documents containing sensitive[1] data about living individuals?			✓
	If "Yes" will you gain the consent of the individuals concerned?			

If any of the shaded boxes have been ticked you must work with your supervisor/module leader to explain how the potential ethical issue(s) will be handled (see below).

If there are any other potential ethical issues that you think your supervisor and/or the Ethics Committee should consider please explain them in the box below. It is your obligation to bring to the attention of your supervisor/the Ethics Committee any ethical issues not covered on this form.

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[1] Sensitive data are *inter alia* data that relates to racial or ethnic origin, political opinions, religious beliefs, trade union membership, physical or mental health, sexual life, actual and alleged offences.

Supervisor's declaration

As the supervisor/module leader *(please delete as necessary)* for this student project, I confirm that I believe that all research ethical issues have been dealt with in accordance with University policy and the research ethics guidelines of the relevant professional organisation.

Date 27/07/2021   **Name** Oleg Golubchikov
                                           Signature

Please explain how the identified potential research ethics issue(s) will be handled.

The data usage and collection in Smart City projects can be a complicated subject. In the interviews, the focus of questions will be about the changes over the city and how it is affecting the citizens and their rights. The rights of citizens must be discussed/asked considering the ethical issues. But it seems most of the talks won't go into personal details, they rather will be about general issues over the public. Therefore it won't cause any ethical problems.

To prevent any unwanted ethical issues, these ethical considerations will be talked with the interviewees before the interviews.